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pressure P depending on this velocity and on the rate of expansion $\frac{l'}{l}$.

" It may be remarked, in conclusion, that for the completeness of the theory, and to show the connexion between all the variables of the problem, we should add equation (1) to the two given by the Comte de Pambour, and thus, between the four quantities, v, R, P', P, we will have, in the general case, the three following equations, leaving one of those quantities indeterminate.

$$\frac{l'}{l} + \frac{l'+c}{l} \log \frac{l+c}{l'+c} = \frac{n+qR}{n+qP'} \qquad \text{(A)}$$

$$va\frac{l'+c}{l} = \frac{S}{n+qP'} \qquad \text{(B)}$$

$$v = f\frac{a'}{a}\sqrt{\left(\frac{2g}{qw} \log \frac{n+qP}{n+qP'}\right)}. \qquad \text{(C)}$$

Professor Harrison made the following remarks on the Larynx, Trachea, and Œsophagus of the Elephant:

" My principal object in the present communication is to direct attention to a particular muscle in the elephant, connecting the back of the trachea to the fore part of the œsophagus, and to which I would give the name of ' trachea-œsophageal muscle.' As I do not find any mention of this in Camper's works, or in the Encyclopedie Methodique, or in the article ' Pacchydermata,' by R. Jones, in Todd's Cyclopedia of Anatomy, I conclude it has not been observed by former anatomists.

" My attention was accidentally directed to it in the course of the dissection of the thoracic viscera. When removing the lungs and heart, I remarked an unusually close connexion to exist between the trachea and œsophagus, and which, on examination, I found depended on a short, thick muscle, which extended from the back part of the bifurcation of the trachea to the fore part of the œsophagus, and along which the fibres

Proceedings R.I.A. Vol. IV. p. 133.

descended to its lower or gastric extremity. The muscle was enveloped in that cellulo-elastic tissue which abounds in almost all parts of this animal, especially in the thorax, where it connects the lungs to the ribs and diaphragm (there being no pleural membranes), and extends from the latter along the œsophagus and trachea, connecting all parts intimately together. On dissecting through this tissue, the muscle in question was exposed: it may be described as an azygos muscle, placed horizontally in the median line, about two inches in its long axis,—that is from the trachea to the œsophagus, and about an inch in its vertical diameter; its anterior end arises from the posterior surface of the bifurcation of the trachea, by short tendinous fibres; these soon end in fleshy fasciculi, and form a thick, strong muscle, which passes backwards and bends a little downwards to the fore part of the œsophagus, along which the fibres descend, expand, and become continuous with its longitudinal and spiral fibres, and can be distinctly traced to the cardiac orifice of the stomach; the upper margin of the muscle is round, thick, and well defined; the lower margin is concave, and held in connexion with the diaphragm, and with its œsophageal opening, by the elastic tissue before mentioned. The pneumogastric nerves descend one along each side of this muscle, and give small branches to it. (See Plate).

" Imperfectly acquainted as we are with the habits and functions of this interesting group of the animal kingdom, in their natural state of liberty and of health, we cannot speak with confidence as to the design or use of this peculiar structure. We do know, however, that an intimate and a very peculiar connexion exists between the mechanical apparatuses concerned in the functions of respiration, of prehension of food, and of deglutition; and that the powerful and exquisitely organized proboscis is not merely a weapon of defence and of offence, but that it also serves as a breathing tube, and in a great measure as an instrument of voice; while at the same time it is the sole organ for the prehension of food, both solid and liquid. Viewing the attachments of this muscle, we may consider its power or action as twofold; first, supposing the trachea to be its fixed point, it might have some influence in raising the diaphragm, and thereby assisting in expiration; or it might raise the cardiac orifice of the stomach, and so aid this organ to regurgitate a portion of its contents into the œsophagus: as, however, we have no satisfactory evidence that this animal ever ruminates, it is useless to speculate on this supposed action of this muscle. Secondly, if we regard the œsophageal extremity of this muscle as the fixed point, and which we are entitled to do from its close connexion to the diaphragm and to the surrounding elastic tissue, it may then exert a twofold action on the trachea; first, it may dilate the thin and dilatable portion at its bifurcation, and thus assist in forming a reservoir of air previous to its forcible expulsion; or secondly, by depressing and fixing the trachea during the act of expiration, it may perhaps contribute to the more powerful expulsion of the air, by enabling the expiratory agents to act with concentrated energy on the lungs and on the air passages above, in those violent expiratory acts which the animal so frequently performs, as in blowing through the proboscis so as to produce loud trumpet-sounds, or in ejecting the water which he had previously drawn through it into the fauces, and which he is enabled to eject with extraordinary force,—sometimes upwards into the air, apparently for pleasure, sometimes at his enemy, in anger,—and frequently over different portions of his body, for the purpose of removing irritation from the skin, or for refreshing and cooling its surface, when exposed to a burning sun.

Although the elephant and horse are placed by naturalists in the one class, the 'Pacchydermata,' yet they differ materially in many parts of their organization, and in none more than in the anatomy of the larynx and trachea. The os hyoides and laryngeal cartilages are very large in the elephant, but possess little elasticity, a property eminently remarkable in those of the horse ; in the latter, the epiglottis is very large, erect, elastic, and light-coloured ; but in the elephant it is short and thick, with but little elasticity, and covered by a soft, pulpy, mucous membrane. The chordæ vocales are short and weak, the superior are wanting, and there are no ventricles or sacculi laryngis ; whereas in the horse the chordæ are beautifully developed, the rima is narrow, and the ventricles are very capacious, and when distended bulge out between the fasciculi of the thyro-arytenoid muscles. In both animals the hyo-epiglotidean muscles are very large, but particularly so in the elephant ; in the latter, the general laryngeal tube is very dilatable, but the rima is very deficient, and the contrary is the case in the horse. We may infer, therefore, that in the latter the function of voice essentially resides in the larynx, though modified by the passage of the air through the fauces and nares; whereas in the elephant the larynx would appear to have little effect on the air, in producing those varieties of tone so peculiar to this animal. In fact, the elephant may be said to have two distinct voices; one is the loud, monotonous roar, caused by the forcible passage of the air through the dilated larynx; the other consists of those piping trumpet-sounds, effected by the action of the numerous muscles of the proboscis on the air passing through this double tube.

" The trachea in the horse is eminently elastic, dilatable, and contractile; the extremities of the cartilages overlap each other, and the transverse muscular fibres pass beneath these, and are inserted into the cartilages a little behind their centre, so that a transverse section of the tube gives the appearance of its being divided into two, the anterior larger one for the passage of the air, the posterior smaller one occupied by reticular tissue. In the elephant the trachea possesses but little elasticity, the cartilages are nearly annular, and their extremities are connected by tough ligamentous tissue, in which I cannot discover any transverse muscular fibres."